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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/800,467	03/15/2004	Robert A. Hasenbein	09991-123001	3190

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EXAMINER	
GARCIA JR, RENE	
ART UNIT	**PAPER NUMBER**
2853	

DATE MAILED: 02/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/800,467	HASENBEIN ET AL.	
	Examiner	Art Unit	
	Rene Garcia, Jr.	2853	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-41* is/are rejected.

7)☒ Claim(s) *11,16,29-31 and 34* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 July 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/8/05; 9/12/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-10, 12-15 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Kusunoki et al. (US 2004/0207671).

Kusunoki et al. discloses the following claimed limitations:

*regarding claim 1, method for driving a droplet ejection device/**ink jet head, 14/** having an actuator/**piezo type inkjet head/**, comprising: (paragraph 0084)

*applying a multipulse waveform comprising two or more drive pulses to the actuator to cause the droplet ejection device to eject a single droplet of a fluid (paragraph 0119)

*wherein a frequency of the drive pulses is greater than a natural frequency, f_j of the droplet ejection device (paragraph 0118-0119)

*regarding claim 2, multipulse waveform has two drive pulses (paragraph 0119)

*regarding claim 3, multipulse waveform has three drive pulses (paragraph 0119)

*regarding claim 4, multipulse waveform has four drive pulses (paragraph 0119)

*regarding claim 5, pulse frequencies are greater than about 1.3 f_j (paragraph 0119)

*regarding claim 6, pulse frequency is greater than about 1.5 f_j (paragraph 0119)

*regarding claim 7, pulse frequency is between about 1.5 f_j and about 2.5 f_j (paragraph 0119)

*regarding claim 8, pulse frequency is between about 1.8 f_j and about 2.2 f_j (paragraph 0119)

*regarding claim 9, two or more pulses have the same pulse period (fig. 11)

*regarding claim 10, individual pulses have different pulse periods (fig. 12 & 15)

*regarding claim 12, two or more pulses comprise one or more unipolar pulses (fig. 10)

*regarding claim 13, droplet ejection device comprises a pumping chamber and the actuator is configured to vary the pressure of the fluid in the pumping chamber in response to the drive pulses (paragraph 0091-0093)

*regarding claim 14, each pulse has an amplitude corresponding to a maximum or minimum voltage applied to the actuator, and wherein the amplitude of at least two of the pulses are substantially the same (fig. 11 & 12)

*regarding claim 15, each pulse has an amplitude corresponding to a maximum or minimum voltage applied to the actuator, and wherein the amplitude of at least two of the pulses are different (fig. 10)

*regarding claim 17, droplet ejection device is an ink jet (paragraph 0002 & 0080)

3. Claims 18-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Oikawa (US 2002/0039117).

Oikawa disclose the following claimed limitations:

*regarding claim 18, method comprising driving a droplet ejection device with a waveform comprising one or more pulses each having a period less than about 20 microseconds to cause the droplet ejection device to eject a single droplet in response to the pulses (paragraph 0003, 0094-0097)

*regarding claim 19, one or more pulses each have a period less than about 12 microseconds (fig. 1 & 11-13; paragraph 0097)

*regarding claim 20, one or more pulses each have a period less than about 10 microseconds (fig. 1 & 11-13; paragraph 0097)

*regarding claim 21, method comprising driving a droplet ejection device with a multipulse waveform comprising two or more pulses each having a pulse period less than about 25 microseconds to cause the droplet ejection device to eject a single droplet in response to the two or more pulses (paragraph 0003, 0094-0097)

*regarding claim 22, two or more pulses each have pulse period less than about 12 microseconds (fig. 1 & 11-13; paragraph 0097)

*regarding claim 23, two or more pulses each have pulse period less than about 8 microseconds (fig. 1 & 11-13; paragraph 0097)

*regarding claim 24, two or more pulses each have pulse period less than about 5 microseconds (fig. 1 & 11-13; paragraph 0097)

*regarding claim 25, droplet has a mass between about 1 picoliter and 100 picoliters (fig. 1)

*regarding claim 26, droplet has a mass between about 5 picoliters and 200 picoliters (fig. 1)

4. Claims 28, 32 and 33 are rejected under 35 U.S.C. 102(b) as being anticipated by Akiyama et al. (US 6,378,972).

Akiyama et al. discloses the following claimed limitations:

*regarding claim 28, apparatus, comprising:

*droplet ejection device/**ink jet head**/ having a natural frequency f_j /**Helmholtz Oscillation**/ (col. 4, lines 22-34)

*drive electronics coupled to the droplet ejection device (col. 4, lines 1-8)

*wherein during operation the drive electronics drive the droplet ejection device with a multipulse waveform comprising a plurality of drive pulses having a frequency greater than f_j (col. 4, lines 1-8; col. 5, lines 45-50; col. 2, lines 55-59)

*regarding claim 32 during operation the droplet ejection device ejects a single droplet in response to the plurality of pulses (col. 2, lines 55-64)

*regarding claim 33, droplet ejection device is an ink jet (ABS; col. 3, lines 35-40)

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Oikawa (US 2002/0039117).

Oikawa discloses the following claimed limitations:

*regarding claim 27, droplet has a mass between about 42ng

Oikawa does not disclose the following claimed limitations:

*regarding claim 27, droplet has a mass between about 50 picoliters and 1000 picoliters

Oikawa discloses the claimed invention except for droplet has a mass between about 50 picoliters and 1000 picoliters. It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize a droplet mass between about 50 picoliters and 10000 picoliters, since it has been held that where general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. ***In re Aller, 105 USPQ 233. Range***

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to utilize a droplet mass about 42ng as taught by Oikawa for the purpose of allowing increased pulse width and droplet size to vary ink density i.e. print quality.

7. Claims 35-41 are rejected under 35 U.S.C. 103(a) as being unpatentable by Akiyama et al. (US 6,378,972) over Ishikawa (US 6,350,003).

Akiyama et al. discloses the following claimed limitations:

*regarding claim 35, method for driving a droplet ejection device**/ink jet printer/** having an actuator**/piezo electric type head/**, comprising: (col. 1, lines 14-17; co. 1, lines 25-29)

*applying a multipulse waveform comprising two or more drive pulses to the actuator to cause the droplet ejection device to eject a droplet of a fluid (col. 2, lines 55-64)

*wherein at least about 60% of the droplet's mass is included within a radius, r, of a point in the droplet, where r corresponds to a radius of a perfectly spherical droplet given by

$$r = \sqrt[3]{\frac{3}{4\pi}\frac{m_d}{\rho}},$$

*where m_d is the droplet's mass and ρ is the fluid density (known formulas for Volume of spherical object ($V_{sp} = (4/3)*\pi*r^3$) and Total volume of an object ($V = m_d/\rho$) and solved for r; therefore mass percentage is a matter of disclosed r)

*regarding claim 36, droplet has a velocity of at least about 4 ms^{-1} (fig. 4-6; col. 4, lines 24-34)

*regarding claim 37, droplet has a velocity of at least about 6 ms^{-1} (fig. 4-6; col. 4, lines 24-34)

*regarding claim 38, droplet has a velocity of at least about 8 ms^{-1} (fig. 4-6; col. 4, lines 24-34)

*regarding claim 39, frequency of the drive pulses is greater than a natural frequency, f_j of the droplet ejection device (col. 5, lines 45-50)

*regarding claim 40, at least about 80% of the droplet's mass is included within r of a point in the droplet (known formulas for Volume of spherical object ($V_{sp} = (4/3)*\pi*r^3$) and Total

volume of an object ($V = m_d/\rho$) and solved for r; therefore mass percentage is a matter of disclosed r)

*regarding claim 41, at least about 90% of the droplet's mass is included within r of a point in the droplet (known formulas for Volume of spherical object ($V_{sp} = (4/3)*\pi*r^3$) and Total volume of an object ($V = m_d/\rho$) and solved for r; therefore mass percentage is a matter of disclosed r)

Akiyama et al. does not disclose the following claimed limitations:

*regarding claims 35, 40 and 41, droplet has spherical shape

Ishikawa discloses the following:

*regarding claims 35, 40 and 41, droplet has spherical shape (fig. 5e and 6e)

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to utilize a droplet with a spherical shape as taught by Ishikawa into Akiyama et al. for the purpose of keeping the droplet intact [due to forces during ejection] and reduce aerosol formation.

Allowable Subject Matter

8. Claims 11, 16, 29-31 and 34 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The primary reason for the allowance of claim 11 is the inclusion of the method steps of an ink jet recording device that includes two or more pulses comprise one or more bipolar pulses. It is these steps found in each of the claims, as they are claimed in the combination, that has not been

found, taught or suggested by the prior art of record which makes these claims allowable over the prior art.

The primary reason for the allowance of claim 16 is the inclusion of the method steps of an ink jet recording device that includes amplitude of each subsequent pulse in the two or more pulses is greater than the amplitude of earlier pulses. It is these steps found in each of the claims, as they are claimed in the combination, that has not been found, taught or suggested by the prior art of record which makes these claims allowable over the prior art.

The primary reason for the allowance of claims 29-31 and 34 is the inclusion of the limitations being for a droplet ejection device wherein harmonic content of the plurality of drive pulses at f_j is less than about 50% of the harmonic content of the plurality of the drive pulses at f_{max}, the frequency of maximum content. It is these limitations found in each of the claims, as they are claimed in the combination, that has not been found, taught or suggested by the prior art of record which makes these claims allowable over the prior art.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Saka et al. (US 6,276,772) includes driving pulses to eject droplets with varying frequencies and piezoelectric elements.

Communications with the USPTO

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rene Garcia, Jr. whose telephone number is (571) 272-5980. The examiner can normally be reached on M-F 8:00AM - 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen D. Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Rene Garcia Jr
16 February 2006

K. FIGGINS
PRIMARY EXAMINER